PUBLICATIONS AND PATENTS OF THE U. S. FRUIT AND VEGETABLE PRODUCTS LABORATORY WINTER HAVEN, FLORIDA

1933 - 1959

Southern Utilization Research And
Development Division
Agricultural Research Service
U. S. Department of Agriculture

A LIST OF PUBLICATIONS AND PATENTS,

with abstracts, reporting
utilization research conducted

at the

U. S. FRUIT AND VEGETABLE PRODUCTS LABORATORY
(Formerly the U. S. Citrus Products Station)
Winter Haven, Florida

Revised and Edited by
Madeline G. Lambou

1960

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U. S. FRUIT AND VEGETABLE PRODUCTS LABORATORY
600 Avenue S, N. W.
Winter Haven, Florida

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IMPROVED COTTONSEED MEALS FOR FEEDING POULTRY AND SWINE

THE BRINING AND PICKLING OF CUCUMBERS AND OTHER VEGETABLES

U. S. Food Fermentation Laboratory
Raleigh, North Carolina

LIST OF PUBLICATIONS, WITH ABSTRACTS

U. S. Fruit and Vegetable Products Laboratory
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TWENTY YEARS OF TUNG RESEARCH

SRRL PUBLICATIONS ON PEANUTS

RICE RESEARCH AT THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

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(in preparation)

PUBLICATIONS AND PATENTS OF THE SOUTHERN UTILIZATION RESEARCH AND DEVELOPMENT DIVISION

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U. S. FRUIT AND VEGETABLE PRODUCTS LABORATORY

Winter Haven, Florida

The laboratory is now located in new, larger, and improved facilities at 600 Avenue S, NW., in the northern part of Winter Haven, just east of Highway 17, facing Inman Park. The laboratory was occupied in November, 1958, and dedicated on December 4, 1958. These facilities have been designed especially for fundamental investigations, particularly on factors related to flavor, flavor stability, and physical stability of food products. Pilot plant facilities have been provided for preparing materials of known history for examination in the chemical laboratory and for testing laboratory developments. In the new laboratory, citrus products will continue to receive major consideration, while the processing of vegetables and other subtropical fruits will also receive extensive study.

The new U. S. Fruit and Vegetable Products Laboratory replaced the old U. S. Citrus Products Station located at 500 Third Street, SW., which was established in 1931 in response to the urgent need for research to develop processed products and byproducts which would afford profitable outlets for surplus or cull fruit from Florida's growing citrus industry. Efforts during the first ten years of the Station's existence placed major emphasis on problems of canning single-strength orange and grapefruit juices. During that period, however, some attention was also given other citrus products, recovery and utilization of byproducts, utilization or disposal of processing wastes, and utilization of a few of the other subtropical fruits of the area.

Shortly before entrance of the United States into World War II, emphasis in research was shifted to national defense and war work. Beginning in 1942 the program was augmented by participation of the Florida Citrus Commission under a cooperative agreement by which from three to five Research Fellows of the Commission were assigned to the Station for five years, up to 1947. Among the projects receiving particular attention were citrus concentrates, problems in substitution of glass for tinplate in canning citrus products, continued investigation of off-flavor in processed citrus juices, microbiological problems, production of powdered orange juice, processed tangerine and lime products, and pectin concentrates, and disposal or utilization of cannery wastes. Limited attention was also given a number of commodities other than citrus.

Since 1945 primary attention has been given to persisting old problems, and to new problems developing with the expansion of the citrus processing industry, particularly production of frozen concentrate. More and more emphasis has been and is being placed on development of fundamental information, which is becoming increasingly important to the intelligent study of problems in maintaining consistently high quality and stability of citrus juice products.

From the beginning, the program of the Winter Haven Laboratory has involved sustained close contact and at least informal cooperation with industry and appropriate agencies of the State of Florida. Articles and patents presenting the research accomplishments of the Station and cooperating agencies from its establishment through 1959 are contained in this list of publications.

SUBJECT INDEX

(By Item Number)

PUBLICATIONS AND PATENTS

114. MATERIALS BALANCES IN THE CONCENTRATION OF ORANGE JUICE.

Scott, W. C. and Morgan, D. A.

Proc. Fla. State Hort. Soc., 72, 285-90 (1959).

The solids content of orange juices before and after concentration, in eleven laboratory tests and one 72-hour commercial run, were determined by vacuum drying, by refractometer, and by acid titration. The range of variations of output from input for total and soluble solids by drying and for acid content was 3.0 to 3.5% with the average variation for any method no greater than ± 1.3%. This indicates no appreciable losses by entrainment or otherwise in the evaporation process . The refractometric method indicated more solids in concentrates than in the single strength juices from which they were made, with an average "gain" of 2.6%, and a maximum variation of 5.9% . This indicates for the method an increased positive error in concentrates over single-strength juices. Acid titration is suggested as the most practical method for following materials through plant operations.

113. PROCESSING FREEZE-DAMAGED ORANGES.

Bissett, O. W.

Proc. Fla. State Hort. Soc., 71, 254-9 (1958).

Studies were conducted on the utilization of Parson Brown, Pineapple, and Valencia oranges which had been damaged in the freezes of the 1957-58 season. No differences in either physical characteristics or flavor were observed in the processed products from fruit which had been separated into two portions according to extent of freeze damage. Varying the time intervals between freezing and harvesting did not affect pectinesterase (PE) activity, total pectin, soluble pectin, flavonoids, relative viscosity, cloud stability, or gelation. Juice yields decreased with increased time intervals following freezing. Juice yields, PE activity, total pectin, flavonoid, and relative viscosity values increased with finisher pressure. Valencia concentrates contained less PE and total pectin and had lower relative viscosity values than concentrates from Parson Brown and Pineapple varieties. Heat treatment at 190° F. prevented cloud loss in all products and only concentrates from Parson Brown and Pineapple oranges processed in the Model F finisher were subject to gelation.

112. FIVE-YEAR STORAGE OF FROZEN CONCENTRATED ORANGE JUICE AT -4°, 5°, AND 10° F.

Kew, T. J.

Proc. Florida State Hort. Soc., 70, 182-4 (1957).

The effects of storage over a five-year period were observed on commercial frozen concentrated orange juice at -4°, 5°, and 10° F. At -4° F. cloud remained unchanged, gelation was not observed, good flavor was retained, and Vitamin C was very stable. At 5°, and 10° F. loss of cloud, gelation, and flavor deterioration were observed. For the retention of optimum quality, storage temperature should be maintained below zero.

111. THE EFFECT OF TIME AND TEMPERATURE OF PASTEURIZATION ON THE QUALITY OF CANNED CITRUS JUICES.

Kew, T. J., Veldhuis, M. K., Bissett, O. W., and Patrick, R.

U. S. Dept. Agr. ARS-72-6, 17 pp. (1957).

Fifteen lots of grapefruit juice and 19 lots of orange juice were subjected to pasteurization with variations in speed and temperature of treatment. After canning, samples were compared to determine the effects of variations in heating practices. Cloud stabilization was often but not always achieved at the temperatures that resulted in enzyme inactivation. Temperatures required for cloud stabilization varied somewhat with speed of pasteurization and with pH.

110. [1] STABILITY OF FROZEN CONCENTRATED ORANGE JUICE. V. THE EFFECT OF HEAT TREATMENT AT INTERMEDIATE STAGES OF CONCENTRATION ON JUICES PREPARED FROM VALENCIA ORANGES.

Carroll, E. A., Guyer, R. B., Bissett, O. W., and Veldhuis, M. K.
Food Technol., 11, 516-9 (1957).

Heat treatment at 150° and 160° F. was less effective in inactivation of the pectinesterase enzyme when applied to single-strength juice than when applied to more concentrated juices. In the first two seasons' investigations, concentrates heated at 150° to 180° F. at densities of 20° to 55° Brix retained cloud for six weeks at 40° F. Treatment of single-strength juice gave less cloud stability at lower treatment temperatures. During the third season equipment modifications produced a juice more nearly representative of commercial operations. As compared with the preceding seasons, a more rapid loss of cloud was noted in all samples but the advantage of treatment at concentrations of 20° to 55° Brix was more pronounced. No differences were observed in flavor of products of the first two seasons while in the third season there was a significant difference (1% level) between controls and products heated at 180° F.

109. [1] STABILITY OF FROZEN CONCENTRATED ORANGE JUICE. IV. EFFECT OF HEAT TREATMENT ON HAMLIN, PINEAPPLE, AND VANENCIA JUICES AT DIFFERENT STAGES OF MATURITY.

Bissett, O. W., Veldhuis, M. K., Guyer, R. B., and Miller, W. M.
Food Technol., 11, 512-5 (1957).

Juice from Hamlin, Pineapple and Valencia oranges was processed into frozen concentrate at frequent intervals of time. Packs were prepared with heat treatments of 150°, 160°, 170°, and 180° F. Concentrates were examined for pectinesterase activity, cloud stability, and flavor. Concentrates from Valencia oranges were most stable, and from Hamlin oranges least stable. No effect of heat treatment on flavor was observed, except for late Pineapple concentrate treated at the two higher temperatures. No effect of maturity was observed for Hamlin or Pineapple products on enzyme inactivation or cloud stability, but Valencia responded better to heat stabilization in early season.

108. EFFECTS OF FINISHER PRESSURE ON CHARACTERISTICS OF VALENCIA ORANGE CONCENTRATE.

Bissett, O. W., and Veldhuis, M. K.
Proc. Florida State Hort. Soc., 69, 109-12 (1956).

Valencia oranges were processed into frozen concentrates using several finisher pressure settings and heat treatment temperatures. Juice yields increased and finisher wastes decreased with increased finisher pressure settings. No appreciable effect of finisher setting on pectinesterase activity was observed. Soluble pectin increased with both increased finisher setting and heat treatment temperature. Viscosity increased with increased finisher pressure but was not affected by treatment temperature. Treatment at 190° F. stabilized the cloud in concentrates prepared from juices processed at the lower finisher pressures, but it was not effective when higher settings were used.

107. CHEMISTRY AND TECHNOLOGY OF CITRUS, CITRUS PRODUCTS, AND BYPRODUCTS.

USDA Handbook No. 98, 99 p. November 1956.

A comprehensive review of technical literature covering the chemistry and technology of citrus products and byproducts. An index and 495 literature references are included.

[1] In cooperation with Continental Can Co. Chicago, Illinois.

106. [1] STABILITY OF FROZEN CONCENTRATED ORANGE JUICE. III. THE EFFECT OF HEAT TREATMENT IN THE PRODUCTION OF HIGH-BRIX FROZEN CONCENTRATE.

Bissett, O. W., Veldhuis, M. K., Guyer, R. B., and Miller, W. M.
Food Technol., 11, 96-9 (1957).

Cloud in unheated controls of 58.5° Brix was more stable than in controls of 42° Brix. Heat treatment at 150° F. in the preparation of 42° Brix concentrates resulted in cloud stability approximately equal to unheated 58.5° Brix controls. Heat treatment at 150° F. or higher in the preparation of 58.5° Brix concentrates gave complete cloud stability at 40° F. for the full 42-day observation period. When equal amounts of heat treated (150° F.) and unheated 68° Brix concentrates were mixed and cut back with unheated juice to 58.5° Brix, the products were completely cloud stable for the 42 days of observation. No significant difference in flavor between the 42° Brix and 58.5° Brix concentrates was found.

105. COMPOSITION OF COMMERCIAL, SEGMENT, AND PEEL JUICES OF FLORIDA ORANGES.

Swift, L. J., and Veldhuis, M. K.
J. Agr. Food Chem., 5, 49-52 (1957).

Comparative composition studies were conducted throughout a season. Peel juices were always highest in pH, Brix-acid ratio, soluble pectic substances, ascorbic acid, flavonoids, diacetyl, and color, and lowest in acidity and fluorescence. Peel juices were usually highest in soluble solids, specific gravity, and viscosity. During the early part of the season, sucrose was lowest and reducing sugars were highest. Peel juices added at a level of 3% in reconstituted concentrate were detected with significance by a taste panel.

104. [1] STABILITY OF FROZEN CONCENTRATED ORANGE JUICE. II. A COMPARISON OF SEVERAL METHODS OF HEAT STABILIZING FROZEN ORANGE-CONCENTRATE.

Guyer, R. B., Miller, W. M., Bissett, O. W., and Veldhuis, M. K.
Food Technol., 10, 570-4 (1956).

Unheated as well as heat-treated juices were concentrated to 55° Brix. Steam injection was somewhat more effective in reducing enzyme activity at 150° F. than either the plate or small tube heat exchanger, but at 160 to 180° F. little difference was noted. Juice heated by steam injection produced concentrates of equal or slightly greater cloud stability to those heated by the plate or small tube heat exchanger. Differences in cloud stability attained by the three methods are comparatively small. The relative economy and convenience in plant practice will need to be considered in selecting the method used.

103. GROWTH RATES OF LACTOBACILLUS AND LEUCONOSTOC SPECIES IN ORANGE JUICE AS AFFECTED BY pH AND JUICE CONCENTRATION.

Rushing, N. B., Veldhuis, M. K., and Senn, V. J.
Appl. Microbiol., 4, 97-100 (1956).

Growth rates were determined for eight strains of spoilage bacteria in orange juice at concentrations from 12° to 42° Brix and pH from 3.4 to 4.0. Growth rates increased with increasing pH and decreased with increasing concentration. The most rapid growth rate observed corresponds to a generation time of 1.4 hours. This rate is insufficient to explain the development of significant numbers of organisms during the brief time concentrate is in an evaporator. Development of organisms in static pockets or films is a possibility.

102. 'STABILITY OF FROZEN CONCENTRATED ORANGE JUICE. I. THE EFFECT OF HEAT TREATMENT ON ENZYME INACTIVATION AND CLOUD STABILITY OF FROZEN CONCENTRATE MADE FROM PINEAPPLE AND VALENCIA ORANGES.

Guyer, R. B., Miller, W. M., Bissett, O. W., and Veldhuis, M. K.
Food Technol., 10, 10-16 (1956).

The effect of heat on pectinesterase inactivation and cloud stability in frozen concentrates from Pineapple and Valencia oranges is reported. Temperatures of 150° F. and above reduced pectinesterase activity substantially and delayed loss of cloud. There was a pronounced increase in cloud stability as the temperature was raised to 170° and 180° F. without a corresponding decrease in pectinesterase activity, indicating that some factor other than the enzyme is important in cloud stability.

101. CHANGES IN COMMERCIAL FROZEN ORANGE CONCENTRATES STORED AT SEVERAL TEMPERATURES.

Kew, T. J.
Proc. Florida State Hort. Soc., 68, 167-70 (1955).
Citrus Ind., 37 (No. 4), 10-13 (1956).

Commercial frozen orange concentrates were stored for periods up to three years at temperatures from 35° F. to -4° F. The average time required in storage for the cloud density to decline to half its initial value was two days at 35°, five days at 20°, 42 days at 15°, 361 days at 10°, in excess of 600 days at 5° F. At -4° F. storage temperature, this cloud value was never reached. Gelation followed a similar pattern. Flavor and Vitamin C retention were excellent at -4° F. storage temperature after three years.

100. A PROPOSED STANDARD FOR DESIGNATION OF "CLOUD" IN CITRUS JUICES.

Senn, V. J., Murray, M. D., and O'Connor, R. T.
U. S. Dept. Agr. ARS-72-8, 11 pp. (1955).

Partial loss of cloud is considered one of the first indications of deterioration in citrus juices, and standards for the uniform designation of degree of turbidity are proposed in this publication. Commercial 325 mesh bentonite in a dilute solution of ammonium chloride is used for the standards for calibration of colorimeters intended for cloud determination. Details of the method, including preparation of standards, transmittance tables, bentonite equivalents of colorimeter dial divisions, and the designation of cloud values in terms of bentonite are given.

99. FROZEN GRAPEFRUIT, TANGERINE, AND LIMEADE CONCENTRATES.

Veldhuis, M. K., Scott, W. C., and Griffiths, F. P.
Food Technol., 9, 198-201 (1955)

The principal properties and problems of frozen grapefruit, tangerine, and limeade concentrates are discussed. Grapefruit concentrates are somewhat lacking in cloud stability, therefore heat treatment is used. Tangerines are fragile, irregular in shape, and present problems in juice extraction and finishing. Lime juice may be merely sweetened in the preparation of concentrate for limeade or more concentrated products may be prepared by evaporation under low pressure and reinforcement of flavor with puree. Satisfactory frozen concentrates have been commercially prepared from all three types of fruit. Results of laboratory analyses are given for nine samples of grapefruit, three of tangerine, and eight of limeade concentrates.

98. EFFECT OF CARBON DIOXIDE AND CERTAIN OTHER CHEMICALS ON THE KEEPING QUALITY OF SINGLE-STRENGHT AND CONCENTRATED ORANGE JUICE.

Morgan, D. A., Rushing, N. B., and Miller, W. H.

Proc. Florida State Hort. Soc., 67, 166-70 (1954)

Fresh flavor and cloud were not retained, and pectinesterase activity was not inhibited in samples treated with carbon dioxide under 120 p.s.i. pressure, 250 p.p.m. sulfur dioxide, 0.1% sodium benzoate, or 510 p.p.m. monochloracetic acid when stored at 40°, 60°, or 70° F. Microbiological activity was retarded at 40° F. in all samples except those treated with monochloracetic acid, at 60° F. in all treated samples of concentrated juice, and at 70° F. in samples of concentrated juice treated with carbon dioxide or sulfur dioxide.

97. CONTROLLING FOAM IN SUBMERGED AND AERATED PROPAGATION OF MICROORGANISMS.

Gordon, Willis, O., and Veldhuis, Matthew K.

U. S. Patent No. 2,635,070; April 14, 1953.

(Assigned to the U. S. Govt. as represented by the Secretary of Agriculture)

A continuous process of propagating microorganisms is described. A liquid nutrient is aerated in tanks from which air and foam are discharged from a large-diameter pipe near the top and nutrient is discharged separately from a smaller pipe near the bottom. Foam-forming nutrients can be used without antifoaming agents.

96. PASTEURIZATION AND STORAGE OF SWEETENED AND UNSWEETENED LIME JUICE.

Bissett, O. W., Veldhuis, M. K., and Rushing, N. B.

Food Technol., 8, 136-8 (1954)

Experiments have shown that during production of canned lime juice sufficient heat to inactivate pectinesterase and destroy bacteria is desirable, and that refrigerated storage of the canned juice favors retention of highest quality. Sweetened and unsweetened lime juices were heated to tempratures ranging from 120° F. to 200° F., and tested for stability in storage at 35° F. Effects of the treatments were judged on the basis of bacterial counts, flavor, destruction of pectinesterase, and cloud stability; 150° F. reduced microorganisms to a low level, but 170° F. was required to destroy pectinesterase and insure cloud stability in 35° F. storage. Refrigerated heated products retained flavor practically unchanged for 15 months, but some changes occurred in unheated samples. At 80° F. all samples deteriorated rapidly.

95. LIME JUICE SUPERCONCENTRATES.

Bissett, O. W., Veldhuis, M. K., and Scott, W. C.

Food Eng., 26 (No. 6), 56-7, 190, 193-4 (1954).

Procedures for processing lime juice superconcentrates from which limeade of true flavor can be prepared have been developed and pilot-plant-tested. Greatest advantage is saving in space, without loss in flavor. The products are an 8-fold, sweetened concentrate, requiring only water for reconstitution, and 35-fold unsweetened concentrate needing addition of sugar and water. Equipment required is already on hand in plants.

94. EFFECT OF CONCENTRATION OF ORANGE JUICE AND TEMPERATURE OF STORAGE ON GROWTH AND SURVIVAL OF MICROORGANISMS.

Rushing, N. B., Patrick, R., and Veldhuis, M. K.

Proc. Florida State Hort. Soc., 66, 281-6 (1953)

Samples of concentrated orange juices of 40° to 70° Brix, in 5° steps, were stored at 35°, 50°, and 60° F. for 168 days and examined periodically. No cans of concentrated juice

of 50° Brix or higher swelled in 35° storage, but at 50° and 60° F. swells were observed at all concentrations below 70° Brix. Yeasts were the main spoilage agents except for 40° Brix samples stored at 50° F. where high counts of slime and gumforming bacteria were also found in swelled cans, Coliforms were found in 40° through 65° Brix juices when prepared, but after 6-day storage they were found only in 40°, 45°, and 50° Brix concentrates at 35° F.; and 40° and 45° Brix concentrates at 50° F.; after 14-day storage, none were found.

93. NOTES ON FACTORS ASSOCIATED WITH GELATION IN FROZEN CONCENTRATED ORANGE JUICE.

Huskins, C. W., and Kew, T. J.
Proc. Florida State Hort. Soc., 66, 254-8 (1953).

To gain a better understanding of the causes involved in the gelation of commercial frozen orange concentrate when stored at temperatures above 0° F., the relation between pectinesterase activity and pectin content in commercial frozen orange concentrates has been studied. Samples of orange concentrates obtained from four citrus-processing plants during the 1950-51 canning season and from six plants at the beginning and end of the 1951-52 season were analyzed. The data indicate that gelation is related to pectinesterase activity; as it increases, tendency towards gelation increases.

92. STORAGE CHANGES IN THE PHOSPHORUS, NITROGEN, AND FATTY ACID CONSTITUENTS OF THE LIPID IN CANNED FLORIDA VALENCIA ORANGE JUICE.

Huskins, C. W., and Swift, L. J.
Food Research, 18, 360-3 (1953).

During storage of orange juice at room temperature, there was a considerable loss of nitrogen from the lipid fraction over a period of one year—particularly severe with choline nitrogen. Also noted was a loss of approximately half of the phosphorus, most of it during the first 6 months. There was an overall increase in the percentage of fatty acids because of loss of those portions of phosphatides associated with nitrogen and phosphorus. The only other noteworthy changes in fatty acids were a decrease in iodine value and a slight increase in diene conjugation.

91. [2] STUDIES ON THE RECOVERY OF ESSENCE FROM FLORIDA ORANGE JUICE.

Morgan, D. A., Veldhuis, M. K., Eskew, R. K., and Phillips, G. W. M.
Food Technol., 7, 332-6 (1953).

A system for recovering water-soluble essences of orange juice under vacuum at temperatures of 110-115° F. is described. The orange juice is not noticeably deteriorated at this temperature. A relation is shown between aroma of the essence and peel oil content. The use of water-soluble essence enhanced the floral character of freshly prepared concentrate and reconstituted product.

90. CHANGES IN THE LIPID FRACTION OF VALENCIA ORANGE JUICE DURING PASTEURIZATION.

Huskins, C. W., and Swift, L. J.
Food Research, 18, 305-7 (1953).

Analytical data on composition of lipids from fresh orange juice and from the same juice almost immediately after pasteurization were compared. Comparative analysis of lipids from fresh and pasteurized orange juices showed little change in composition. A slight loss of unsaponifiable matter was noted. It appears unlikely that changes in flavor and lipid composition, due to pasteurization, are closely related.

[2] In cooperation with Eastern Utilization Research and Development Division, Agricultural Research Service, USDA, Philadelphia, Pa.

89. EFFECT OF HEAT TREATMENT TEMPERATURE ON THE STORAGE LIFE OF VALENCIA ORANGE CONCENTRATES.

Bissett, O. W., Veldhuis, M. K., and Rushing, N. B.

Food Technol., 7, 258-60 (1953).

Complete heat stabilization of the cloud in single-strength orange juice, 2-fold, and 4-fold concentrates was attained at 190° F. and 200° F., while 160° F. was sufficient for 6-fold concentrates. Products processed at 160° F. or above were not subject to can swelling during storage at either 35° F. or 80° F. Viable organisms decreased rapidly with increasing temperature up to 150° F., while at higher temperatures decreases in count were not so great for each increase in temperature. Pectinesterase activity was sharply reduced by temperatures of 120° to 150° F., was not appreciably changed between 150° F. and 180° F., and was reduced to very low activity at 190° F., and 200° F.

88. ULTRASONIC TREATMENT OF ORANGE JUICE PRODUCTS.

Kew, T. J.

Proc. Florida State Hort. Soc., 65, 242-6 (1952).

The applicability of ultrasonic energy to the processing of orange juice was investigated. Gel structure in orange concentrate was destroyed, but cloud was not dispersed. The activity of the enzyme pectinesterase in orange juice products was not affected by ultrasonic treatment. In orange juice vitamin C was not destroyed by the treatment, nor was the color impaired. Off-flavor and off-odor developed in reconstituted orange juice in orange concentrate.

87. COLIFORM BACTERIA FROM ORANGE CONCENTRATE AND DAMAGED ORANGES.

Patrick R.

Food Technol., 7, 157-9 (1953).

Evidence is presented to show that of 217 coliform cultures obtained from orange concentrate and damaged oranges and grouped in accordance with their IMVIC test reactions, 64% were *Escherichia coli* types, 19% were *Aerobacter aerogenes* types, and 17% were intermediate types. Of the *E. coli* types 41% gave IMVIC patterns considered of sanitary significance.

86. REDUCTION OF ORGANIC MATTER IN CITRUS PRESS LIQUOR BY AERATED YEAST PROPAGATION.

Veldhuis, M. K.

Citrus Ind., 33 (No. 9), 11-12 (1952). Also in Eng. Progr. Univ. Florida Bull. Ser. No. 57, 24-6 (1952).

The yeast, *Torulopsis utilis,* under a continuous method of propagation, was found to complete depletion of sugars in citrus press liquors within a detention time of 2.5 to 3 hours under a wide range of conditions. It was found, however, that under some conditions substantial quantities of volatile materials (alcohols and esters) may be formed. Yeast propagation rapidly utilized the sugars which constitute about two-thirds of the soluble solids in citrus press liquor. The remaining organic materials consist mainly of pectin, pectin degradation products, glycosides (naringin and hesperidin), and salts of citric acid.

85. CONSTITUTION OF THE LIPID FROM STORED FLORIDA VALENCIA ORANGE JUICE.

Huskins, C. W., Swift, L. J., and Veldhuis, M. K.

Food Research, 17, 109-16 (1952).

In lipids obtained from stored pasteurized Florida Valencia orange juice, the ratio of phosphorus to nitrogen was 1 to 2. Conjugated fatty acids increased while nonconjugated

acids decreased, and considerable breakdown occurred in the lipid fraction during storage. The resin acids contained phthalic acid, whereas this acid was not found in freshly pasteurized juice lipid. From the analyses obtained, it would be difficult to predict the state of the lipid after storage.

84. FLAVOR CHANGES IN STORED CANNED ORANGE JUICE.

Swift L. J.

Proc. Florida State Hort. Soc., 64, 181-5 (1951).

Two theories to account for the development of off-flavor in canned orange juice on storage were investigated: that off-flavors are due to changes in the *d*-limonene of the peel oil; and that they are due to changes in the lipid constituents of the juice. At present, peel oil is indicated as a source of the typical storage flavor and lipid constituents may also play a role. Further work is in progress.

83. ISOLATION OF BETA-SITOSTERYL-D-GLUCOSIDE FROM THE JUICE OF FLORIDA VALENCIA ORANGES *(CITRUS SINENSIS,* L.)

Swift, L. J.

J. Am. Chem. Soc., 74, 1099-1100 (1952).

The aim was to identify the components of the steryl glycoside occurring in orange juice. Structure was determined by identifying component parts and derivatives. Glucose was identified by qualitative and quantitative determinations. Beta-sitosterol was identified via the acetate and benzoate. The tetraacetate and tetrabenzoate of beta-sitosterol-D-glucoside were also prepared.

82. SPRING HOLDER FOR CAPILLARY-MELTING-POINT TUBES.

Swift L. J., and Bissett, O. W.

Chemist Analyst, 41, 44 (1952).

The holder is made of sheet brass and grips the thermometer stem by spring tension. As many as five capillary tubes may be inserted at one time.

81. FATTY ACIDS OF THE LIPIDS FROM FRESHLY CANNED FLORIDA VALENCIA ORANGE JUICE.

Swift, L. J.

Food Research, 17, 8-14 (1952).

The lipid material from freshly canned orange juice was separated by filtering the juice with a filter aid and extracting the filter cake with acetone. The acids were separated by the usual method of saponification, freed from their soaps, and esterified. The resulting methyl esters were analyzed by spectrophotometric means and by chemical examination of fractions obtained by fractional distillation. The results of the methyl ester analysis are as follows: conjugated diene, 1.3%; conjugated triene, 0.2%; linoleate, 32.5%; oleate, 18.1%, palmitoleate, 10.4%; myristate, 0.5%; palmitate, 18.8%; stearate, 1.7%; unidentified acid (mol. wt. 344), 1.4%; not determined. 6.2%.

80. THERMAL CONDUCTIVITY IN ORANGE CONCENTRATE.

Morgan, D. A.

Proc. Florida State Hort. Soc., 64 192-8 (1951).

The equations of unsteady state heating or cooling can be applied to 58.9° Brix orange concentrate for prediction of heating or cooling times, and also to 42° Brix concentrate above its freezing point. The average value for the coefficient of thermal conductivity for 58.9°. Brix concentrate was found to be 0.17 B.t.u./hr./sq.ft./°F./ft.; and for 42° Brix concentrate it was 0.18 B.t.u./hr./sq.ft./°F./ft.

79. SOURCES OF COLIFORM BACTERIA IN CITRUS JUICE FOR CONCENTRATES.

Patrick, R.

Proc. Florida State Hort. Soc., 64, 178-81 (1951).

Possible sources of coliform bacteria in citrus juice concentrates were water for washing the fruit; exteriors of the fruit; the fruit juice itself; scale insects; and fruit flies (Drosophila). Presumptive coliform tests and plate counts, which are given for 9 groups of samples, showed that coliforms were found in significant numbers on exteriors of fruit infected with scale insects, in juice from damaged fruit, and from fruit flies.

78. HYGROSCOPIC CHARACTERISTICS OF DRIED CITRUS PULPS CONTAINING CITRUS MOLASSES.

Bissett, O. W., and Veldhuis, M. K.

Feedstuffs, 23 No. 36, 26, 28, 30, 31 (1951).

Dried citrus pulps with varying citrus molasses content were prepared and subjected to relative humidities from 40 to 80%. Relative humidity was the predominating factor, although somewhat higher moisture contents accompanied higher molasses content. No samples showed mold growth at 70% relative humidity and all samples molded at 80% humidity. Results indicate dried citrus pulp with added molasses can be handled in the same manner as dried citrus pulp alone.

77. [3] STORAGE TEMPERATURE EFFECTS ON FROZEN CITRUS CONCENTRATES.

DuBois, C. W., and Kew, T. J.

Refrig. Eng., 59, 772-5, 812 (1951).

Commercial frozen concentrates of orange, grapefruit, tangerine, and blended grapefruit and orange juices were stored at various temperatures and examined periodically. No consistent changes in viscosity were found. Bacteriological counts dropped rapidly in all instances. Cloud loss, changes in flavor, and can condition were also considered. Results showed that temperature and time of storage are important factors in maintaining stability and acceptability of such concentrates.

76. CHEMISTRY AND TECHNOLOGY OF CITRUS.

Veldhuis, M. K.

Yearbook of Agr. (U. S. Dept. Agr.) 1950-51, 263-7.

(Yearbook Separate No. 2201).

Citrus Ind., 32 (No. 8), 7-9 (1951).

Developments since 1936 in technology of canning of citrus fruits have transformed them from a rarity to one of our most common foods. Citrus products discussed are pasteurized single-strength juices; concentrated pasteurized juices; frozen single-strength juices; frozen concentrates; frozen citrus purees; powdered orange juice; and canned and frozen citrus sections. Processes for manufacturing each of these products are described.

75. [4] MAKING USE OF TONS OF CITRUS WASTE.

Owens, H. S., Veldhuis, M. K., and Maclay, W. D.

Yearbook of Agr. (U. S. Dept. Agr.) 1950-51, 268-74.

(Yearbook Separate No. 2202).

Useful products such as dried pulp, molasses, pectin, essential oils, brined peel, citric acid, limonene, feed yeast, and biologically active materials made from citrus canning plant residues, are discussed. Special processes and equipment for their manufacture and some of their uses are described.

[3] In cooperation with Minute Maid Corp., Plymouth, Florida.

[4] In cooperation with Western Utilization Research and Development Division, Albany, California.

74. CONSTITUTION OF THE JUICE LIPIDS OF THE FLORIDA VALENCIA ORANGE *(CITRUS SINENSIS* L.).

Swift, L. J., and Veldhuis, M. K.

Food Research, 16, 142-6 (1951)

Lipid material of Florida Valencia orange juice has been isolated and approximate analysis has been made. The particular sample isolated contained about one-third phosphatides in spite of the fact that extraction was made with acetone. The percentage of unsaponifiable matter was considerably lower than has been found on earlier samples, an indication that lipid constitution is subject to considerable variation.

73. CITRUS JUICE AND REMOVAL OF VOLATILE OILS THEREFROM.

Pulley, George N., and Veldhuis, Matthew K.

U. S. Patent 2,510,138, June 6, 1950.

(Assigned to U. S. Govt. as represented by the Secretary of Agriculture.)

The patent covers a method of simultaneously pasteurizing juice and removing volatile oils therefrom. The juice is heated to boiling at substantially atmospheric pressure and from 0.5 to 5% of the juice vaporized. Efficiency of deoiling is improved by maintaining juice and vapors in intimate contact for at least 3 seconds.

72. A METHOD FOR ESTIMATING SOLUBLE SOLIDS IN DRIED CITRUS PULP.

Bissett, O. W.

Proc. Florida State Hort. Soc., 63, 174-9 (1950).

Method consists essentially of boiling a 25 g. sample of pulp in 200 gs. of water for 20 minutes, cooling, replacing water lost during heating, stirring for two minutes, filtering through a dry filter aid pad, determining soluble solids by refractometer or spindle, and multiplying by nine. The method was demonstrated on 23 samples of pulp. It is simple, rapid, and suited to routine use in a citrus feed mill.

71. AN INDEX OF PASTEURIZATION OF CITRUS JUICES BY A RAPID METHOD OF TESTING FOR RESIDUAL ENZYME ACTIVITY.

Kew, T. J., and Veldhuis, M. K.

Proc. Florida State Hort. Soc., 63, 162-5 (1950).

This test is based on activity of the pectinesterase enzyme. Conditions are made favorable for high activity of this enzyme, the pH adjusted with methyl red and observations made for changes in pH. Activity can be detected in unpasteurized juices in ten minutes and in borderline samples in 4 hours. An increase in acidity as indicated by the methyl red is considered a positive test. If the samples arethen allowed to stand overnight in a refrigerator, a gel forms that can easily be seen if the enzyme has not been inactivated.

70. [5] CITRUS CANNERY WASTE, ITS USE AND DISPOSITION.

von Loesecke, H. W.

U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-290, 18 pp. (1950).

This publication reviews the processing of citrus cannery waste, such as peel and pulp, for various uses, including dried pulp or ensilage for livestock and poultry feed and other products from peel, citrus molasses, press liquor, oil from seeds, and disposal of cannery effluents. There are 65 references.

69. MICROBIOLOGICAL SURVEYS OF CITRUS PROCESSING PLANTS DURING THE 1948-49 SEASON.

Patrick, R.

U. S. Dept. Agr., Bur. Agr. Ind. Chem., AIC-259, 19 pp. (1950).

A survey of total microbe counts was conducted using four media; these media were rated on the basis of numbers only after many processing plants were investigated during

[5] Utilization Research, Agricultural Research Service, USDA, Washington, D. C.

the season. Unwashed fruit that was not over-mature and had been promptly diverted to processing plants did not constitute a major problem for the operator. Washing reduced peel contamination. Clean equipment, short holding time of product, and handling at low temperatures enabled an operator to obtain low count. Slush freezing of concentrate usually produced an apparent increase in numbers. Buffering reconstituted juice previous to plating did not increase the count.

68. THE ROLE OF MICRO-ORGANISMS AND STORAGE TEMPERATURES ON THE QUALITY OF ORANGE CONCENTRATE.

Patrick, R.

Proc. Florida State Hort. Soc., 62, 174-7 (1949).

Microbiological examinations were made of samples of frozen orange concentrate from each of the Florida plants producing this product during the 1948-49 season. Number of viable organisms were determined by plating on four different media in most cases, and on five media in a few cases. Results show that frozen concentrate stored at the higher temperature (42° F.), corresponding to ordinary refrigerator temperatures, will be much more susceptible to rapid spoilage. In a few samples, substantial numbers of organisms remained viable at cold (42°) and frozen (0°) storage. The cloud was destroyed in all samples stored at the higher temperature whereas this clarification was not shown by samples at zero.

67. FROZEN PUREES FROM FLORIDA CITRUS FRUITS.

Bissett, O. W.

Proc. Florida State Hort. Soc., 62, 163-5 (1949).

Purees were prepared from a number of varieties of citrus fruits. Valencia oranges are recommended particularly for use in preparing orange sherbet. Purees were made by quartering the fruit and passing it through a screw type finisher of 0.027 in. perforations. The finisher removed seeds and most of pulp and yielded a juice containing about 1% peel oil. Since it is high in peel oil, puree is excellent as a flavoring material.

66. TANGERINE SEED OIL.

Swift, L. J.

J. Am. Oil Chemists' Soc., 26, 438-41 (1949).

An analysis of tangerine seed oil was made and chemical and physical properties presented. Evidence for the presence of linolenic, linoleic, oleic, palmitic, stearic arachidic, and an unidentified hydroxy acid was obtained and percentages of these acids were determined.

65. [6] THE COMPOSITION OF FLORIDA CITRUS MOLASSES.

Royo, Iranzo, J., and Veldhuis, M. K.

Proc. Florida State Hort. Soc., 61, 205-11 (1948)

Citrus Ind., 30 (No. 4), 3, 15, 18, 19, 22 (1949).

Thirteen samples of citrus molasses were analyzed and the following average values were obtained: 71.37° Brix by refractometer, 72.28° Brix by spindle (dilution method), 70.43% total solids, 42.09% total sugar (calculated as invert), 22.44% reducing sugar (calculated as invert), 3.81% protein, 1.07% pectin (alcohol precipitate), pH 4.68, 0.64% total acidity, 0.053% volatile acidity, 4.77% ash, 29.84% Ca in ash, and 2.14% Mg in ash. Viscosities were determined, and Maerz and Paul values are given.

64. [7] METHOD OF PREPARING FULL-FLAVORED FRUIT JUICE CONCENTRATES.

MacDowell, Louis G., Moore, Edwin L., and Atkins, Cedric D.

U. S. Patent 2,453,109, Nov. 9, 1948.

(Assigned to U. S. Govt. as represented by the Secretary of Agriculture).

Steps for concentrating at a temperature below 80° F. (to prevent flavor damage) to

[6] In cooperation with Spanish Government Research Fellow.
[7] In cooperation with Florida Citrus Commission.

5- to 8-fold, diluting to 3- to 4-fold concentration with fresh deaerated juice (cutback juice) to restore original aroma, flavor and palatability, packing under vacuum and freezing are explained.

63. ASCORBIC ACID LOSSES AND DARKENING ON STORAGE AT 49° C. (120° F.) OF SYNTHETIC MIXTURES ANALOGOUS TO ORANGE JUICE.

Curl, A. L.

Food Research, 14, 19-14 (1949).

Ascorbic acid losses and darkening were measured in thirteen synthetic solutions analogous to orange juice on storage in enamel and plain tin cans at 120° F. for 30 and 60 days. Considerable losses of ascorbic acid were observed in the presence of buffer only, and somewhat greater losses in the presence of sugars. Darkening occurred mainly in the presence of both sugars and amino acids.

62. GAS FORMATION IN CONCENTRATED ORANGE JUICE AND ANALOGOUS SYNTHETIC MIXTURES.

Curl, A. L.

Food Research, 13, 381-6 (1948).

Formation of gas in concentrated orange juice and analogous synthetic mixtures on storage at 120° F. was studied. Addition of ascorbic acid markedly increased gas production. Added amino acids had less effect. Synthetic mixtures, containing sugars evolved no gas. Similar mixtures containing also 0.2% ascorbic acid evolved small amounts of gas; when compounds of metal having more than one valence, such as Sn and Cu, were added to this mixture, gas production was considerably greater. Mixtures containing dextrose or levulose plus 2% ascorbic acid evolved considerable gas. Mixtures containing sugars plus ascorbic acid plus amino acids yielded gas in a quantity about the same as in concentrated orange juice.

61. THE COMPOSITION OF THE SUGARS IN FLORIDA VALENCIA ORANGE JUICE.

Curl, A. L., and Veldhuis, M. K.

Fruit Prod. J., 27 (No. 11), 342-3, 361 (1948).

Evidence for presence of sucrose and invert sugars as principal sugars in Florida Valencia concentrated orange juice was obtained by a comparison of chemical and polarimetric data. Averaging six samples, 50.5% of the total sugar content was estimated as sucrose, 23.7% as dextrose, and 25.8% as levulose. Results are in approximate agreement with those of previous investigators with oranges from other regions.

60. BACTERIOLOGICAL SURVEY OF SOME CITRUS CANNERIES IN FLORIDA WITH SPECIAL ATTENTION TO *ESCHERICHIA COLI.*

Patrick, R.

Proc. Florida State Hort. Soc., 60, 36-8 (1947).

Samples of fresh juice from 10 citrus canning plants were collected over a period of three years and plated on eosin methylene blue agar. Typical sheen producing colonies were checked by the IMVIC tests. No cultures gave a test pattern typical of *E. coli.*

59. EXPERIMENTS ON PRODUCTION OF FEED YEAST FROM CITRUS PRESS JUICE.

Veldhuis, M. K., and Gordon, W. O.

Proc. Florida State Hort. Soc., 60, 32-6 (1497).

Studies on adaptation of the continuous method developed at the Southern Regional Research Laboratory are discussed. It was demonstrated that continuous operation over extended periods of time was possible without loss of activity of the culture of *Torulopsis*

utilis. Approximately 500 cubic feet of air were required per pound of dry yeast produced. Sugars were reduced by 95%, total organic matter 65%, and B.O.D. 80% in the propagator. Ammonium sulfate and trisodium phosphate were added nutrients.

58. AN EXPERIMENT ON PARTIAL CONCENTRATION AS A MEANS OF STANDARDIZING LOW-SOLIDS ORANGE JUICE.

Moore, E. L., MacDowell, L. G., Atkins, C. D., and Huggart, R. L.
Fruit Prod. J., 27 (No. 3), 72-4 (1947). (Reprints not available).

Packs of Hamlin orange juice as extracted (7.43° Brix), concentrated to 10.65° Brix, and with concentrate added to 10.70° Brix were put up in plain tin cans, and examined initially and after three and six months storage. Different methods of preparation gave no significant differences in ascorbic acid retention during either storage period. After three months storage at 80° F., samples were submitted to 39 commercial canneries for flavor evaluation and tasted by 210 people. There were no marked differences in preference between the concentrated and concentrate-ade packs but a marked preference for either in comparison to the control pack. Flavor of the early-season, low-acid orange juice was materially improved either by concentration or addition of some concentrate.

57. CONCENTRATED ORANGE JUICE STORAGE STUDIES. THE EFFECTS OF DEGREE OF CONCENTRATION AND TEMPERATURE OF STORAGE.

Curl, A. L.
Canner, 105 (No. 13), 14-16, 38, 40, 42 (1947).

Seven batches of orange juice, varying in concentration from 13 to 71% soluble solids, were prepared from one lot of Indian River Valencia oranges. The juices, packed in citrus-enamel cans, were stored at 40°, 60°, 80°, 100°, and 120° F. for periods up to 12 months. Each pack at each storage temperature was examined five times, including an initial analysis, for vacuum or pressure in the can, ascorbic acid, total and reducing sugars, and color (of the filtered reconstituted juice). Flavor ratings were made of the reconstituted juices. In general, the higher the storage temperature and the more concentrated the product, the more rapid the deterioration as represented by these factors.

56. COMPARISON OF SEVERAL TYPES OF APPARATUS DEVISED FOR THE DETERMINATION OF VOLATILE OIL IN CITRUS JUICES.

Curl, A. L.
J. Assoc. Offic. Agr. Chemists, 30, 567-75 (1947).

Design and dimensions of apparatus for determination of peel oil in citrus juices by distillation are important in convenience and accuracy of determinations. A new-type apparatus was compared with two types in common use and shown to be as accurate as the Wilson or Clevenger. Speed of operation was increased by employing a micro-buret, so that a 500 ml sample of juice may be used.

55. THE ORIGIN OF THE OFF-FLAVOR WHICH DEVELOPS IN PROCESSED ORANGE JUICE.

Curl, A. L., and Veldhuis, M. K.
Fruit Prod. J., 26 (No. 11), 329-30, 342 (1947).

A study of 18 experimental packs of orange juice in glass containers was made in order to obtain more information on the origin of off-flavor which develops on storage at room temperature. The fraction responsible for the major part of the off-flavor was found to be the suspended material, which includes the lipid or fatty fraction. Filtered juices developed some off-flavor on storage at 80° F., but the change was much less than in whole juices and quite different in character. Peel oil was not responsible for much, if any, of the off-flavor;

in some cases it appeared to mask the off-flavor instead. Reconstituted orange juice concentrates and a juice pressed from peeled fruit developed about as much off-flavor as juice from unpeeled fruit. The water-soluble ester or essence fraction had little or no effect on development of the off-flavor.

54. INDUSTRIAL WASTES—CITRUS CANNING INDUSTRY.

McNary, R. R.

Ind. Eng. Chem., 39, 625-7 (1947). (Reprints not available).

Changing conditions in the citrus industry and effects on waste disposal are reviewed. In ten years the percentage of the grapefruit crop processed has increased from 22% to 69% and of oranges from 1.4% to 38.5%. Peel is used principally in the manufacture of dried citrus pulp and citrus molasses. Disposal of waste water from citrus canneries poses a difficult problem.

53. CONCENTRATED ORANGE JUICE STORAGE STUDIES WITH PARTICULAR REFERENCE TO THE DEVELOPMENT OF SWELLS.

Curl, A. L., Moore, E. L., Wiederhold, E., and Veldhuis, M. K.

Fruit Prod. J., 26 (No. 4), 101-9, 121 (1946).

Pasteurized, unpasteurized, and benzoated concentrated orange juices of about 65° Brix were stored at 40°, 80°, 95°, and 120° F. In one unpasteurized pack fermentation developed and cans swelled in four or five days at 80° and 95° F. In other cans at these temperatures swells developed more slowly. No swelled cans were noted in 12 months storage at 40° F. Swelled cans developed within two weeks at 120° F., three months at 95° F. and six months at 80° F. Data on microbial counts, darkening, ascorbic acid content, sugar inversion, and flavor during storage are included.

52. THE DETERMINATION OF CRUDE LIPID IN CITRUS JUICES.

Swift, L. J.

J. Assoc. Offic. Agr. Chemists, 29, 389-95 (1946).

A method was devised that is suited to routine laboratory work. Lipids are separated from juice by filtration using disintegrated filter paper as a filter aid. After washing, paper pulp and lipid are transferred to a Soxhlet extractor and extracted with acetone and petroleum ether. Solvents are dried and evaporated and the residue weighed.

51. OFF-FLAVOR DEVELOPMENT IN PROCESSED TANGERINE JUICE.

Curl, A. L.

Fruit Prod. J., 25 (No. 12), 356-7 (1946).

A study of experimental packs revealed that it is possible to can tangerine juice of good quality, with a stability similar to orange juice. Exclusion of peel and pulp extractives seemed to be an important factor. In properly prepared juices, suspended matters appeared to be responsible for a major portion of the off-flavor developed. Peel oil seemed to mask off-flavor development.

50. CITRUS FRUIT PRODUCTS RESEARCH.

Veldhuis, M. K.

Proc. Florida State Hort. Soc., 58, 51-5 (1945). (Reprints not available).

The previous year's work of the Station is reviewed. Recent investigations on gas formation in concentrated orange juice stored at room temperature, low-temperature frozen citrus concentrates, method of estimation of peel oil in citrus juices, lipids in citrus juices, bacteriological problems, tangerine products, powdered citrus juice, and flavor recovery are discussed.

49. ' THE CONCENTRATING AND DRYING OF CITRUS JUICES.

Moore, E. L., Atkins, C. D., Wiederhold, E., MacDowell, L. G. and Heid, J .L.
Proc. Inst. Food Technologists 160-8 (1945). (Reprints not available).

Drying by sublimation, vacuum drying, spray drying, concentration by evaporation, concentration by crystallization and frozen orange juice concentrate are discussed in this review.

48. ' A NOTE ON OBSERVATIONS ON RETARDING DEVELOPMENT OF CHANGES IN FLAVOR AND COLOR OF GLASS PACKED GRAPEFRUIT JUICE.

Wiederhold, E., Moore, E. L., and Atkins, C. D.
Fruit Prod. J., 25 (No. 4), 104-5 (1945). (Reprints not available)

Preliminary investigations indicate the possibility that a brief period of cold storage at 32-40° F. immediately after packing might have some beneficial effect on retention of color and flavor of glass-packed grapefruit juices after they are brought out to room temperature. Results of examination of experimental packs are described.

47. ' VITAMIN C CONTENT OF PROCESSING RESIDUE FROM FLORIDA CITRUS FRUITS.

Atkins, C. D., Wiederhold, E., and Moore, E. L.
Fruit Prod. J., 24 (No. 9), 260-2, 281 (1945). (Reprints not available).

Four varieties of Florida oranges and two of Florida grapefruit were analyzed to determine content of vitamin C and its distribution in the fruit. About three-fourths of the vitamin was contained in the peel and rag of the fruit and about one-fourth in the juice. Preliminary experiments indicated that peel-and-rag residues remaining after extraction of juice retain relatively high vitamin C content, and may be considered as a potential source of this vitamin.

46. ' FLAVOR AND ASCORBIC ACID RETENTION IN FRESH FLORIDA CITRUS JUICES.

Moore, E. L., Atkins, C. D. Wiederhold, E., and MacDowell, L. G.
J. Home Econ., 37, 290-3 (1945). (Reprints not available).

Investigations indicate that the length of time freshly extracted orange juice or grapefruit juice may be allowed to stand before use in the home is limited by loss of palatability and beginning of fermentation, not by appreciable ascorbic acid losses. Machine and hand-reamed juices were kept in covered and uncovered containers at 40° and 70° F. for periods up to one week. At 40° F. the ascorbic acid retention ranged from 96.2 to 99% during the week. Samples at 70° F. retained from 97.2 to 98.5% vitamin C for three days and then had to be discarded because of excessive fermentation.

45. ' ASCORBIC ACID RETENTION IN FLORIDA GRAPEFRUIT JUICES. III. AS RELATED TO INDIVIDUAL FACTORS OF CANNING PLANT OPERATION.

Wiederhold, E., Atkins, C. D., and Moore E. L.
Canner, 100 (No. 23), 12-14, 23 (1945). (Reprints not available)

Retention of vitamin C was found to be related to methods used in preparing commercial juices. Good retention of vitamin C was observed when copper or other metals that might catalyze oxidation of ascorbic acid were present. Incorporation of unnecessary air in juice was avoided. Tubular pasteurizers were used instead of kettle-type pasteurizers. There was thorough deaeration of juice, good vacuum in the can and a minimum of headspace in cans stored at 40° F.

44. THE CITRUS CANNING WASTE DISPOSAL PROBLEM IN FLORIDA.

Ingols, R. S.

Sewage Works J., 17, 320-9 (1945). (Reprints not available).

Disposal of liquid citrus canning wastes is discussed. Liquid wastes of canning plants are rather dilute and primarily a sanitary disposal problem. Descriptions are given of methods in use and others that could be used. Liquid waste from cattle-feed plants is a press liquor containing about 10% solids. Methods for disposing of this liquor and for manufacturing several products are described. Results of a pilot plant study of citrus canning plant wastes showed that it should be possible to treat concentrated wastes from juicing plants.

43. ASCORBIC ACID RETENTION IN FLORIDA GRAPEFRUIT JUICES. II. DURING STORAGE OF THE CANNED PRODUCTS.

Moore, E. L., Wiederhold, E., and Atkins, C. D.

Canner, 100 (No. 8), 55-7 (1945). (Reprints not available).

Samples of canned grapefruit juices from 12 commercial canning plants were obtained and stored at room temperature. Average room temperature was 78° F. Average retention of vitamin C was 95% at the end of 2 months, 90% at the end of 4 months and 83% at the end of 6 months storage.

42. INVESTIGATION ON CITRUS FRUIT PRODUCTS.

Veldhuis, M. K.

Proc. Florida State Hort. Soc., 57, 51-5 (1944). (Reprints not available).

Citrus Ind., 26 (No. 1), 6-7, 15, 18 (1945). (Reprints not available).

Results of studies conducted during the year are discussed. Included are tangerine products, concentrated orange juice, powdered citrus juices, retention of vitamin C during canning and storage, a comparison of orange and grapefruit juices in tin and glass containers, disposal of liquid citrus plant wastes, and crude citrus pectin.

41. A SECOND YEAR OF CITRUS RESEARCH ON BYPRODUCTS AND PROBLEMS OF THE CITRUS CANNING AND CONCENTRATING INDUSTRY IN FLORIDA.

Anonymous

Fruit Prod. J., 24 No. 3, 71-3 (1944).

Citrus Ind., 25 (No. 11), 6-8 (1944). (Reprints not available).

This paper reviews the year's work of the Florida Citrus Commission Research Fellows at the U. S. Citrus Products Station. Investigations on concentrated and powdered juices, glass- and tin-packed orange and grapefruit juices, retention of vitamin C in grapefruit juice during commercial canning, recovery of cold-pressed peel oil beverage bases, citrus pomace, and distribution of vitamin C in citrus fruit are discussed.

40. PAPAYA PRODUCTS.

Heid, J. L., and Curl, A. L.

Fruit Prod. J., 24 (No. 2), 41-4, 53 (1944).

Selected varieties of papayas are flavorful, have smooth texture, high content of provitamin A and vitamin C, and are suitable for processing. Methods for preparation of acceptable products by dehydration, canning, pickling, and preserving are described. Dehydrated papaya is believed to be suitable for incorporation in confections and in concentrated food rations.

39. UTILIZATION AND DISPOSAL OF CITRUS PROCESSING RESIDUES.

Ingols, R. S.

Proc. Florida State Hort. Soc., 57, 28-31 (1944). (Reprints not available).

Methods of utilization and disposal are reviewed. Plans are discussed for a small

experimental biological reaction tank in which the wastes are to be held for 24 to 30 hours. It is anticipated that three-fourths of the organic matter will be destroyed during treatment.

38. [T] THE RECOVERY OF FLAVORING OIL FROM PERSIAN LIMES—PRELIMINARY EXPERIMENTS.

Atkins, C. D., Wiederhold, E., and Heid, J. L.

Fruit Prod. J., 23 (No. 10), 306-8 (1944), (Reprints not available).

Preliminary tests were made on the quantity of oil present in and obtainable from cull Persian limes. Cold pressed lime oil was obtained by use of a tapered-screw press and a laboratory model centrifuge. The whole fruit contained 0.32% oil: 0.11 and 0.095 pounds of oil were obtained respectively in two tests. Cold-presed oil obtained thus constituted about one-third that in fresh fruit. Properties of the oil were determined.

37. A COMPARISON OF METHODS FOR THE DETERMINATION OF MOISTURE IN DEHYDRATED VEGETABLES.

Curl, A. L.

Canner, 98 (No. 23), 22-3 (1944).

Benzene distillation, toluene distillation, and vacuum oven methods of estimating moisture were compared for 12 kinds of vegetables. Results indicated that the benzene method is acceptable for all vegetables tested except white potatoes where the toluene procedure is preferable.

36. [T] CHANGES OCCURRING IN ORANGE AND GRAPEFRUIT JUICES DURING COMMERCIAL PROCESSING AND SUBSEQUENT STORAGE OF THE GLASS- AND TIN-PACKED PRODUCTS.

Moore, E. L., Wiederhold, E., and Atkins, C. D.

Fruit Prod. J., 23 (No. 9), 270-5, 285 (1944). (Reprints not available).

Ascorbic acid retention in orange and grapefruit juices during processing averaged 98-99%. Apparently slower cooling of bottled juices did not lower vitamin retention, but a slight cooked flavor was noted in comparison with canned juices. Retention of vitamin C was somewhat less in glass containers when stored at room temperature, but was still considered good at the end of 6 months. After 6 months storage, orange juices in tin and glass were off-flavor, with the bottled juice slightly better in taste. Bottled grapefruit juice became unpalatable during this period, but canned juice was still satisfactory.

35. [T] GRAPEFRUIT CANNERY WASTE YIELDS CRUDE CITRUS PECTIN.

Pulley, G. N., Moore, E. L., and Atkins, C. D.

Food Inds., 16 (No. 4), 285-7, 327-8 (1944).

A method of preparing dried citrus pomace from grapefruit peel is described. Enzymes were inactivated and most of the soluble material removed by boiling the ground peel for five to seven minutes. The peel was then leached with several changes of cold water, pressed to remove excess water, and dried to 4-8% moisture content. Addition of aluminum sulfate to the late leach water improved pressing water from the peel. Dried pomace may be used for preparation of pectin solutions for jam and jelly manufacturing.

34. [T] TANGERINE JUICE PRODUCTS.

Atkins, C. D., Moore, E. L., and Heid, J. L.

Fruit Prod. J., 23 (No. 5), 132-4, 152, 153, 157 (1944). (Reprints not available).

Republished under title "Tangerine Juice Concentrates: A Method of Utilizing Cull Tangerines in Preparing a Tangerine Syrup and Beverage Base."

Citrus Ind., 25, 3 (1944).

Studies on juice canning and on preparation of bland syrups, filtered beverage base con-

centrate and unfiltered cloudy beverage base concentrate are described. Bland syrups are considered as having good possibilities. They were prepared by boiling juice with calcium carbonate filtering,, adjusting the pH to 5.2 by adding citric acid, treating with decolorizing carbon, and concentrating under vacuum.

33. ASCORBIC ACID RETENTION IN FLORIDA GRAPEFRUIT JUICES. I. DURING COMMERCIAL CANNING.
Moore, E. L. Weiderhold, E., Atkins, C. D. and MacDowell, L. G.
Canner, 98 (No. 9), 24-6 (1944). (Reprints not available).

A survey was made of ascorbic acid retention in Florida grapefruit juices during commercial canning in 12 Florida canning plants. Equipment was taken into the respective canneries and analyses were made without delay. Results showed an average ascorbic acid retention of 97% during commercial canning.

32. THE UTILIZATION OF FLORIDA FRUITS AND VEGETABLES.
Heid, J. L.
Proc. Florida State Hort. Soc., 56, 56-9 (1943). (Reprints not available).

31. CITRUS RESEARCH IN FLORIDA.
Anonymous.
Canner, 97 (No. 24), 11 (1943). (Reprints not available).

30. PROGRESS OF EXPERIMENTS IN PACKING FLORIDA CITRUS JUICES IN GLASS.
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